1. A process for producing a clear, colorless solution of a metal oxy peroxide of the formula $MO(OOH)_x$ where x is 2, 3, 4, or 6 comprising

forming an aqueous solution of a metal peroxide having the formula $M(OOH)_y$, where y is 2, 3, 4, or 6 where such solution is substantially free of other peroxides of the metal, diluting the solution to a metal peroxide concentration of between about 0.5% and about 0.85% by weight of the solution at a pH in the range of from about 4.0 to about 6.5, heating the solution to boiling for a period of from about 1 to about 4 hours, cooling the solution, reheating the solution to boiling for a period of between about 1 and about 2 hours, cooling the solution, reheating the solution to boiling until the peroxide concentration in the solution is in the range of from about 12.5% to about 25% by weight of the initially present metal peroxide, and cooling the resulting clear colorless solution.

2. The process of claim 1 where the metal peroxide is selected from the group consisting of peroxides of a metal of group III of the Periodic Table.

3. The process of claim 1 where the metal peroxide is selected from the group consisting of peroxides of a metal of group II of the Periodic Table.

4. The process of claim 1 where the metal peroxide is selected from the group consisting of peroxides of Sc, La, Yttrium, platinum, selenium tin, vanadium, zirconium, hafnium, aluminum and iron.

5. The process of claim 1 where the metal peroxide is selected from the group consisting of peroxides of the lanthanide series of elements.

6. The process of claim 1 where the metal peroxide is selected from the group consisting of peroxides of platinum, selenium and tin.

7. The process of claim 1 where the metal peroxide is selected from the group consisting of peroxides of zirconium and hafnium.

8. The process of claim 1 where the metal peroxide is titanium peroxy acid.

9. The process of claim 1 where the initial metal oxy peroxide concentration is between about 0.65% and about 0.85% by weight.

10. The process of claim 1 where the initial metal oxy peroxide concentration is between about 0.4% and about 0.65% by weight.

11. The process of claim 1 where the pH of the peroxide solution is in the range of from about 5.0 to about 6.0.

12. The process of claim 1 where the peroxide concentration in the clear, colorless solution is in the range of from about 19% to about 25% by weight of the initially present metal peroxide.

13. The process of claim 1 where the peroxide concentration in the clear, colorless solution is in the range of from about 12.5% to about 19% by weight of the initially present metal peroxide.

14. The product of the process of claim 1.

15. The product of the process of claim 2.

16. The product of the process of claim 3.

17. The product of the process of claim 4.

18. The product of the process of claim 7.

19. The product of the process of claim 8.

20. A process for producing nanoparticles of a metal or metal compound of less than 10 nanometers in size comprising

forming a solution of the metal peroxide having the formula $M(OOH)_x$ where x is 2, 3, 4, or 6 from a hydroxide sol of the metal, diluting the solution to a metal peroxide concentration of between about 0.5% and about 0.85% by weight of the solution at a pH in the range of from about 4.0 to about 6.5, heating the solution to boiling for a period of from about 1 to about 4 hours, cooling the solution, reheating the solution to boiling for a period of between about 1 and about 2 hours, cooling the solution, and reheating the solution to boiling until the peroxide concentration in the solution is essentially zero and separating the nanoparticles.

21. The process of claim 20 where the metal peroxide is selected from the group consisting of peroxides of a metal of group III of the Periodic Table.

22. The process of claim 20 where the metal peroxide is selected from the group consisting of peroxides of Sc, La,

Yttrium, platinum, selenium tin, vanadium, zirconium, hafnium, aluminum and iron..

23. The process of claim 20 where the metal peroxide is titanium peroxy acid.

24. The product of the process of claim 21.

25. The product of the process of claim 22.

26. The product of the process of claim 23.

27. A process for producing nanoparticles of a metal or metal compound of less than 10 nanometers in size comprising

forming a solution of a metal oxy peroxide of the formula $MO(OOH)_x$ where x is 2, 3, 4, or 6, by decomposition of a solution of the metal peroxide having the formula $M(OOH)_x$ where x is 2, 3, 4, or 6, which was formed from a hydroxide sol of the metal, diluting the solution of the metal oxy peroxide to a peroxide concentration of between about 0.25% and about 0.425% by weight of the solution at a pH in the range of from about 4.0 to about 6.5, heating the solution to boiling for a period of from about 1 to about 4 hours, cooling the solution to ambient temperature, reheating the solution to boiling for a period of between about 1

and about 2 hours, cooling the solution to ambient temperature, and reheating the solution to boiling until the peroxide concentration in the solution is essentially zero and separating the nanoparticles.

28. The process of claim 27 where the metal peroxide is selected from the group consisting of peroxides of a metal of group III of the Periodic Table.

29. The process of claim 27 where the metal peroxide is selected from the group consisting of peroxides of Sc, La, Yttrium, platinum, selenium tin, vanadium, zirconium, hafnium, aluminum and iron..

30. The process of claim 27 where the metal peroxide is titanium peroxy acid.

31. The product of the process of claim 27.

32. The product of the process of claim 28.

33. The product of the process of claim 29.

34. The product of the process of claim 30.

35. A coated substrate prepared by coating the substrate with the composition of claim 14 and drying the coated substrate.

36. A coated substrate prepared by coating the substrate with the composition of claim 15 and drying the coated substrate.

37. A coated substrate prepared by coating the substrate with the composition of claim 16 and drying the coated substrate.

38. The coated substrate of claim 35 where the coating is applied by spraying or dipping.

39. The coated substrate of claim 35 where the coating is applied by spraying at a temperature of from about 25 to about 100 ^{0}C.

40. The coated substrate of claim 35 where the coating has a thickness of from about 1 to about 1000 microns.

41. The coated substrate of claim 35 where the coating has a thickness of from about 10 to about 500 microns.

42. The coated substrate of claim 35 where the coating has a thickness of from about 100 to about 250 microns.

43. The coated substrate of claim 35 where the substrate is selected from the group consisting of glass, metal, polymer, ceramic, concrete, masonry, wood, stone, mineral filler and textile.

44. The coated substrate of claim 35 where the substrate is selected from the group consisting of glass, metal, talc (calcium carbonate), china clay (kaolin) and polymer.

45. The coated substrate of claim 35 where the substrate is a microparticle.

46. The coated substrate of claim 35 where the microparticle is a microsphere.

47. The coated substrate of claim 35 microspheres have a diameter in the range of 1 to 100 microns.

48. The coated substrate of claim 35 where the microspheres have a diameter in the range of 1 to 50 microns.

49. The coated substrate of claim 35 where the microspheres have a diameter in the range of 1 to 20 microns.

50. The coated substrate of claim 46 where the microsphere is a clear or translucent glass microsphere.

51. The coated substrate of claim 46 where the glass microsphere is selected from solid and hollow microspheres.

52. The coated substrate of claim 35 where the substrate is a lamellar platelet.

53. The coated substrate of claim 52 where the platelet comprises mica, or a lamellar metal-containing pigment.

54. The coated substrate of claim 52 where the platelet comprises a metal flake or oxide coated-metal flake pigment.

55. The coated substrate of claim 52 where the platelet comprises a metal oxide-coated mica pigment.

56. The coated substrate of claim 52 where the platelet comprises a titanium or iron oxide-coated mica pigment.

57. The coated substrate of claim 28 where the substrate is a pigment.

58. A coating composition comprising nanoparticles admixed with the product of claim 14.

59. The coating composition of claim 58 where the nanoparticles comprise from about 10 to about 90 weight percent of the composition.

60. The coating composition of claim 58 where the nanoparticles comprise from about 25 to about 75 weight percent of the composition.

61. The coating composition of claim 58 where the nanoparticles comprise from about 30 to about 50 weight percent of the composition.

62. The coating composition of claim 58 where the nanoparticles are selected from the group consisting of TiO_2, ZrO_2, ZnO, $SrTiO_3$, CdO, In_2O_3, $BaTiO_3$, K_2NbO_3, Fe_2O_3, Ta_2O_5, WO_3, SaO_2, Bi_2O_3, NiO, Cu_2O, SiO_2, RuO_2, CeO_2 .

63. The coating composition of claim 58 where the nanoparticles are selected from TiO_2 and ZrO_2.

64. The coating composition of claim 58 where the nanoparticles are anatase TiO_2.

65. The coating composition of claim 58 where the nanoparticles are rutile TiO_2.

66. A method of increasing the refractive index of a substrate by at least 0.5 units comprising coating the substrate with the clear colorless solution of claim 14 and drying the coated particle at a temperature in the range of from about 35 to about 80 ^{0}C.

67. The method of claim 66 where the substrate is a microparticle.

68. The method of claim 66 where the microparticle is spherical.

69. The method of claim 66 where the particle is selected from the group consisting of glass and organic polymers.

70. The method of claim 69 where the particle is a polyacrylate or polycarbonate.

71. A process for applying a light-refractive, color-enhancing coating to a substrate comprising:

(1) applying, to a substrate, a composition comprising at least one color-enhancing agent, a binder material comprising the product of claim 14 and transparent or

translucent glass beads having a refractive index between about 1.5 and 2.5, and having a maximum diameter of up to about 20 microns; and

(2) drying the composition to form a light-refracting, color-enhanced, translucent coating which envelops the color-enhancing agent and the transparent or translucent beads which have a maximum diameter which is at least 10% less than the thickness of the cured coating layer and which refracts, scatters and dissipates applied light within the cured coating.

72. The process of claim 71 where the transparent or translucent beads are clear glass and have a refractive index of about 1.9 to about 2.1.

73. The process of claim 71 where the color-enhancing agent is at least one agent selected from the group consisting of dyes, pigments, metallic flakes, mica, opaque glass beads and holographic flakes.

74. The process of to claim 71 where the transparent or translucent beads comprise a mixture of beads having different refractive indexes.

75. The process of claim 71 where the color-enhancing agent comprises metallic flakes.

76. The process of claim 71 where the transparent or translucent beads are colorless, transparent glass beads.

77. The process of claim 71 where the color-enhancing agent comprises mica particles.

78. The process of claim 71 where the color-enhancing agent further comprises a colored pigment or dye.

79. A process for applying a water based light-refractive, color-enhancing coating to a surface, comprising the steps of

(1) spraying the surface with a composition comprising

(a) at least one color-enhancing agent from the group consisting of dyes, pigments, metallic flakes, mica, opaque glass beads, opaque glass particles of random geometric shape and holographic flakes, and

(b) transparent or translucent glass or plastic beads having a refractive index between about 1.5 and 2.5, a maximum diameter which is up to about 20mu and is at least 10% less than the thickness of the coating, and

(c) a binder material in accordance with claim 14;

(2) heating the coated surface, if necessary to dry the composition to form a light-refracting, color-

enhanced, translucent coating which envelops the color-enhancing agent and the glass or plastic beads and which substantially completely refracts, scatters and dissipates applied light within the coating.

80. The process of claim 79 where the color-enhancing agent is opaque glass beads or opaque glass particles of random geometric shape and the maximum diameter of the beads is between about 10 and 20 microns.

81. The process according to claim 79 where the refractive index is between about 1.9 and 2.1.

82. Process according to claim 80 where the glass beads comprise a mixture of beads having different refractive indexes.

83. Process according to claim 79 where the composition comprises a mixture of colorless, transparent glass beads and mica particles.

84. Process according to claim 81 where the composition further comprises a colored pigment or dye.

85. A light-refracting, color-enhancing coating composition comprising a mixture of

(a) at least one color-enhancing agent selected from the group consisting of dyes, pigments, metallic flakes, mica, opaque glass beads, opaque glass particles of random geometric shape, and holographic flakes, and

(b) a mixture transparent or translucent glass beads having a diameter which is up to about 20 microns and having different refractive indexes within the range of about 1.5 and 2.5, and

(c) the binder material in accordance with claim 14

86. The composition of claim 85 in which the diameter of the glass beads is between about 5 and 20 microns.

87. The composition of claim 85 in which the glass beads comprise a mixture of beads some of which have a refractive index of below about 1.9 and others of which have a refractive index of above about 2.1.

88. The composition of claim 85 where the color-enhancing agent is mica.

89. An improved pigment blend, comprising one or more pigments and a plurality of glass particles selected from the group consisting of glass microspheres having a diameter less than about 50 microns and glass chips having a substantially random geometrical shape and a particle size less than about 50 microns; wherein the glass

particles are at least partially coated with the coating of claim 14.

90. A method of improving a visual appearance of a substrate comprising coating the substrate with a pigment blend comprising a plurality of glass particles selected from the group consisting of glass microspheres having a diameter less than about 50 microns and glass chips having a substantially random geometrical shape and a particle size less than about 50 microns; wherein the glass particles are at least partially coated with the coating of claim 14.

91. The method of claim 90, where the substrate is selected from the group consisting of metal, ceramic, glass, asbestos, human skin, leather, polymer, fabrics, wood, rubber, concrete, brick and asphalt.

92. The method of claim 90, wherein the particle size is less than about 20 microns.

93. The method of claim 90, where the glass particles are selected from the group consisting of colorless, colored, luminescent, or phosphorescent glass particles.

94. The method of claim 93, where the luminescent glass particles are electroluminescent or chemiluminescent.

95. The method according to claim 89, where the glass particles have an index of refraction between 1.5 and 2.5.

96. The method of claim 90, where the glass particles substantially inhibit transmission of light in the ultraviolet spectrum.

97. The method of claim 90, where the glass particles substantially inhibit transmission of light in the infrared spectrum.

98. A method of preventing degradation of a substrate by a topcoat applied thereto comprising coating the substrate with the product of claim 14 and drying such coating prior to applying the topcoat to such substrate.

99. A process for increasing the acid and alkali resistance of a substrate comprising coating the substrate with the product of claim 14 and drying such coating.

100. An method of preventing the migration of labile ions from a substrate containing labile ions comprising coating the substrate with the product of claim 14 and drying such coating.

101. The method of claim 100 were the labile ions are sodium or potassium ions.